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THE KELLEX CORPORATION

ENGINEERING DESCRIPTION

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW	
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SECTION 1400

~~CONDITIONING AREA~~

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BOOK IX

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ENGINEERING DESCRIPTION

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C-216 DISPOSAL K-1405

The C-216 Disposal Plant, K-1405, consists primarily of an alkaline scrubber which absorbs waste C-216 and H-216 from spent conditioning gases before venting to the atmosphere. These gases are highly toxic and cannot be vented directly. The plant must handle all the C-216 generated by the C-216 plant in Section 1300 or 200 lbs./day. Since the expected C-216 production is closer to 70 lbs./day, the equipment is sufficiently flexible to permit the operation at this lower rate.

FUNCTION

The C-216 Disposal Plant is located north-east of K-1401, as shown in Drawing No. N-3456-O-SK-15E. (See page 2) Drawing Nos. 1400-M-06-AA and 1400-M-06-BA show the equipment location in plan and sectional elevation.

PLANT LAYOUT

The disposal tower (or alkaline scrubber) is located outside. The building itself contains the reaction tank for the regeneration of caustic, storage space for lime, vacuum pumps and an office and a control laboratory. Also outside the building are the caustic storage tanks, the decantation tank and the settling tank.

The absorption tower has sufficient capacity to handle 78 cfm of gas containing 20% C-216 and 10% H-216. It allows a contact time with alkali solution of at least a minute when the flow is maintained counter-currently to a stream of 5-10% caustic solution, flowing at rates of 50-100 gpm.

PROCESS DESCRIPTION

The exhaust gases enter the tower at 3 points in its base. Seal-pots containing sulphuric acid prevent moisture diffusing back into the line.

The gases come from the following source:-
(1) Manifold vents and cylinder maintenance in K-1303;
(2) Dehydration, cell purging and H-216 absorber stripping, K-1301; (3) Tank Evacuation and purging K-1302, rupture disc vent line K-1303, two vent lines from K-1401; pressure relief on C-216 feed line to K-1401 outside K-1302, discharge from Vacuum Pumps in K-1405, 8" line from Section 300, 4" vent line from rupture discs K-1302.

The liquid flow rate down the tower is set so that the amount of a salt formed per pass does not exceed the saturation point of the liquid, which is 1.4% by weight in a 10% NaOH solution. This ensures complete destruction of C-216 and H-216, reducing the vented gas from the tower to 6 ppm or less.

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The effluent liquor from the tower, containing a salt in solution, is collected so that it can be converted to an insoluble calcium salt by supplying a small stream from a lime slurry tank. The caustic consumed in the tower is thus regenerated. The reaction takes 20 minutes, during which the mix is thoroughly agitated. The reaction liquor then flows by gravity to a settling tank. The clear liquor overflows a weir and is returned to the absorption tower.

Plant storage is provided for 20-25% caustic solution with means to transfer 50% liquor from tank cars. Piping is arranged to permit this dilution in the storage tanks. The storage tanks are equipped with heaters to prevent freezing.

Make-up to the settling tank is direct from storage. Provision is made to decant the clear liquor periodically should solution become fouled through long use. Solids are sluiced to waste into the acid neutralization area (K-1407).

Carbon is required for lining and packing of the absorption tower because of extremely corrosive conditions particularly at the point of entry of the C-216 at the base of the tower. To avoid spontaneous combustion of the pipe with C-216, these lines are constructed of monel. This also minimizes possible corrosion by liquid H-216 solutions formed where water diffuses back into the lines and reacts with C-216.

This flow of caustic liquor is thoroughly distributed through the tower by a perforated ring distributor made of monel pipe. This ring has sufficient holes to distribute the solution over the Raschig Rings which are made of carbon. These Rings were set in the tower, one section 12" high made of 3" rings, and another section 12" high of 2".

In addition to this tower, an emergency stack is provided, to dispose of the exhaust gases when the absorption tower is out of service for repairs or cleanings. It is constructed of 4" monel pipe and extends 70 ft. above the surrounding grade.

The effluent from the tower is transferred by a pump of 125 gpm capacity at 3500 rpm and 25 psig (J-601) to a 2250 gal. reaction tank (F-604) located in the building. Into this tank is pumped the slurry from a 90 gal. lime slaker (F-602) by a pump of 10 gpm at 25 psi and 3500 rpm (J-606). Lime is stored in a 210 CF bin (F-603) from which it can be fed to the slaker placed below it. This feeder has a variable capacity of 150 to 1500# per day. The reaction tank has a mechanical mixer to thoroughly agitate the mix to insure complete reaction or drainage. This mixer is a 27" Duplex Turbo-Mixer with

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bevel gear drive. The slaking tank is provided with a "Lightnin" mixer.

The reaction tank is elevated on structural steel supports and has a sloping base so that it will drain to the settling tank (F-601). This tank has a capacity of 22,000 gal. (20' x 20' x 9' low end x 7'-6" high end.) Pumps of 135 gpm capacity at 50 psi (J-602) are provided to take the NaOH (5 to 25%) from the settling tank to the tower. An additional pump is provided so that the caustic can be handled by either the unloading pump J-604, or J-603. The J-603 pump has a capacity of 250 gpm at 125 psi and has also been piped for use as a slurry pump.

The settling tank has an overflow weir. Two heat exchangers are provided. One Heat Exchanger is used as preheater with steam at 15 psi and capacity of 350,000 btu/hr at MTD 100°F. The other Heat Exchanger is used as a cooler with water at 85°F and capacity of 500,000 btu/hr at MTD 12.3°F.

As slaking generates heat, it is necessary to use a cooler through which the lime slurry passes in transit to the reaction tank, (C-603).

To provide for the necessary storage of caustic, there are two 26,500 gal. steam heated cylindrical tanks (F-605, F-606). The caustic solution is unloaded from tank cars by a special pump with piping from the railroad siding to the tanks. This pump is rated at 100 gpm at 25 psi (J-604).

A Booster Pump (J-607) is used for pumping wash water into the tanks, with a capacity of 100 gpm at 75 psi at 3500 rpm.

Four 100 cfm Stokes Vacuum Pumps, J-605, J-605A, J-605B, and J-605C are installed as standby, emergency equipment. Two of these pumps are to serve the Process Area and two serve the Conditioning Building.

All C-2.6 piping in this building is from the Conditioning Building, K-1401 to K-1405 and extend to the tower on both the suction and discharge of each pump. Crane bellow sealed valves are used throughout.

All other piping in this building is steel, i.e., the air, steam, and water piping. This is shown on Dwg. #1400-A-06-CA. Complete automatic and indicating instruments have been provided for automatic and manual control of the operations throughout the plant.

Because of the many hazards in the operation of this system, a chemical laboratory has been installed so that a close check can be made at all times on operation and the concentration of all of the solutions handled as well as the results obtained.

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